CLAIMS

What is claimed is:

1. An optical amplifying apparatus comprising:

a plurality of optical adjusting means provided for respective wavelength bands, for adjusting optical powers of light beams;

wavelength-multiplexing means for wavelength-multiplexing outputs of said respective optical adjusting means; and

controlling means for performing control so that an output of optical adjusting means for adjusting optical power of shorter-wavelength-band light among said plurality of optical adjusting means becomes larger than an output of optical adjusting means for adjusting optical power of longer-wavelength-band light among said plurality of optical adjusting means.

2. The optical amplifying apparatus according to claim 1, further comprising:

wavelength-demultiplexing means for wavelength-demultiplexing input light into light beams in respective wavelength bands; and

outputting each of the light beams in the respective wavelength bands to said respective optical adjusting means.

3. The optical amplifying apparatus according to claim 1, wherein said controlling means further controls the outputs of said respective optical adjusting means so that optical powers of the respective wavelength bands at a predetermined point will become approximately identical when output light of the wavelength-multiplexing means travels to the predetermined point.

4. The optical amplifying apparatus according to claim 1, wherein said controlling means further controls the outputs of said respective optical adjusting means so that powers obtained by eliminating noise powers in the respective optical adjusting means from optical powers of said respective wavelength bands at a predetermined point will become approximately identical when output light of the

wavelength-multiplexing means travels to the predetermined point.

5. The optical amplifying apparatus according to claim 1, further comprising a light source for supplying light to respective input light beams of said plurality of optical adjusting means.

6. The optical amplifying apparatus according to claim 2, further comprising an optical transmission line connected to said wavelength-demultiplexing means for transmitting said input light, and a light source for supplying light to said optical transmission line.

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7. The optical amplifying apparatus according to claim 2, wherein said controlling means determines a difference between the output of said optical adjusting means for adjusting the optical power of said shorter-wavelength-band light and the output of said optical adjusting means for adjusting the optical power of said longer-wavelength-band light based on at least one of stimulated Raman scattering in an optical transmission line connected to an output side of said optical amplifying apparatus, a loss in said optical transmission line, a loss in said wavelength-demultiplexing means, and a loss in said wavelength-multiplexing means.

8. The optical amplifying apparatus according to claim 1, wherein said light beams are a WDM optical signal in a first wavelength band and a WDM optical signal in a second wavelength band having longer wavelength than the first wavelength band, and wherein

the number of channels of the WDM optical signal in the first wavelength band is increased or decreased.

9. The optical amplifying apparatus according to claim 1, wherein said light beams are a WDM optical signal in a first wavelength band and a WDM optical signal in a second wavelength band having longer wavelength than the first wavelength band, and wherein the number of channels of the WDM optical signal in the second wavelength band is increased or decreased.

10. The optical amplifying apparatus according to claim 3, further comprising detecting means for detecting said

optical powers of said respective wavelength bands at said predetermined point, wherein

said controlling means further controls the outputs of said respective optical adjusting means based on an output of the detecting means.

11. The optical amplifying apparatus according to claim 4, further comprising detecting means for detecting said optical powers of said respective wavelength bands at said predetermined point, wherein

said controlling means further controls the outputs of said respective optical adjusting means based on an output of said detecting means.

12. The optical amplifying apparatus according to claim 10, wherein said light beams are WDM optical signals, and wherein

said detecting means detects optical power of one of the WDM optical signals that corresponds to a shortest-wavelength channel.

13. The optical amplifying apparatus according to claim 11, wherein said light beams are WDM optical signals, and wherein

said detecting means detects optical power of one of the WDM optical signals that corresponds to a shortest-wavelength channel.

14. The optical amplifying apparatus according to claim 1, wherein said plurality of optical adjusting means are optical amplifiers for amplifying said light beams.

15. The optical amplifying apparatus according to claim 1, wherein said plurality of optical adjusting means are optical attenuators for attenuating said light beams.

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16. An optical sending apparatus comprising:

a plurality of optical sending means provided for each predetermined wavelength band, and for generating WDM optical signals in the respective wavelength bands;

a plurality of optical adjusting means connected to said respective optical sending means, for adjusting optical powers of light beams;

wavelength-multiplexing means for wavelength-multiplexing outputs of said respective optical adjusting means; and

controlling means for performing control so that an output of optical adjusting means for adjusting optical power of shorter-wavelength-band light among said plurality of optical adjusting means becomes larger than an output of optical adjusting means for adjusting optical power of longer-wavelength-band light among said plurality of optical adjusting means.

17. The optical sending apparatus according to claim 16, wherein said controlling means further controls the outputs of said respective optical adjusting means so that optical powers of the respective wavelength bands at a predetermined point will become approximately identical when output light of said wavelength-multiplexing means travels to the predetermined point.

18. The optical sending apparatus according to claim 16, wherein said controlling means further controls the outputs of said respective optical adjusting means so that powers obtained by eliminating noise powers in said respective optical adjusting means from optical powers of the respective wavelength bands at a predetermined point will become approximately identical when output light of said wavelength-multiplexing means travels to the predetermined point.

19. The optical sending apparatus according to claim 16, wherein said controlling means determines a difference between the output of said optical adjusting means for adjusting the optical power of said shorter-wavelength-band light and the output of said optical adjusting means for adjusting the optical power of said longer-wavelength-band light based on at least one of stimulated Raman scattering in an optical transmission line connected to an output side of said optical sending apparatus, a loss in said optical transmission line, and a loss in said wavelength-multiplexing means.

20. The optical sending apparatus according to claim 16,

wherein said WDM optical signals in the respective wavelength bands are a WDM optical signal in a first wavelength band and a WDM optical signal in a second wavelength band having longer wavelengths than the first wavelength band, and wherein

the number of channels of said WDM optical signal in the first wavelength band is increased or decreased.

21. The optical sending apparatus according to claim 16, wherein said WDM optical signals in the respective wavelength bands are a WDM optical signal in a first wavelength band and a WDM optical signal in a second wavelength band having longer wavelengths than the first wavelength band, and wherein

the number of channels of said WDM optical signal in the second wavelength band is increased or decreased.

22. The optical sending apparatus according to claim 17, further comprising detecting means for detecting said optical powers of said respective wavelength bands at said predetermined point, wherein

said controlling means further controls the outputs of said respective optical adjusting means based on an output of said detecting means.

23. The optical sending apparatus according to claim 18, further comprising detecting means for detecting one of said optical powers of said respective wavelength bands at said predetermined point, wherein

said controlling means further controls the outputs of said respective optical adjusting means based on an output of said detecting means.

24. The optical sending apparatus according to claim 22, wherein said detecting means detects optical power of one of the WDM optical signals that corresponds to a shortest-wavelength channel.

25. The optical sending apparatus according to claim 23, wherein said detecting means detects optical power of one of the WDM optical signals that corresponds to a shortest-wavelength channel.

26. The optical sending apparatus according to claim 16, wherein each of said plurality of optical sending means

generates each WDM optical signal respectively in each of said plurality of wavelength bands by generating a plurality of optical signals having different optical powers and wavelength-multiplexing said plurality of optical signals on a wavelength band basis.

27. The optical sending apparatus according to claim 16, wherein said plurality of optical adjusting means are optical amplifiers for amplifying light beams.

28. The optical sending apparatus according to claim 16, wherein said plurality of optical adjusting means are optical attenuators for attenuating light beams.

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29. An optical transmission system comprising:

an optical sending apparatus for generating an optical signal of a plurality of wavelength bands;

an optical transmission line for transmitting the generated said optical signal;

an optical receiving apparatus for receiving and processing said optical signal transmitted through said optical transmission line; and

at least one optical amplifying apparatus provided on the optical transmission line, comprising:

wavelength-demultiplexing means for wavelength-demultiplexing said optical signal on a wavelength band basis;

a plurality of optical adjusting means for adjusting optical powers of each said optical signal in the respective wavelength bands, that are output from said wavelength-demultiplexing means;

wavelength-multiplexing means for wavelength-multiplexing outputs of said respective optical adjusting means; and

controlling means for performing control so that an output of optical adjusting means for adjusting optical power of shorter-wavelength-band light among said plurality of optical adjusting means becomes larger than an output of optical adjusting means for adjusting optical power of longer-wavelength-band light among said plurality of optical adjusting means.

30. The optical transmission system according to claim 29, wherein said controlling means of said optical amplifying apparatus further controls the outputs of said respective optical adjusting means so that optical powers of the optical signals in the respective wavelength bands at a predetermined point will become approximately identical when an output optical signal of said optical amplifying apparatus travels to the predetermined point.

31. The optical transmission system according to claim 29, wherein said controlling means of said optical amplifying apparatus further controls the outputs of said respective optical adjusting means so that powers obtained by eliminating noise powers in said respective optical adjusting means from optical powers of the optical signals in said respective wavelength bands at a predetermined point will become approximately identical when an output optical signal of said optical amplifying apparatus travels to the predetermined point.

32. The optical transmission system according to claim 29, wherein said optical amplifying apparatus further comprises a light source for supplying light to an optical transmission line through which an input optical signal is transmitted.

33. The optical transmission system according to claim 29, wherein said optical sending apparatus generates said optical signal of said plurality of wavelength bands by generating said plurality of optical signals having different optical powers and wavelength-multiplexing the plurality of optical signals on a wavelength band basis.

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34. The optical transmission system according to claim 29, wherein said optical receiving apparatus comprises a spectrum detecting section for detecting a spectrum of the optical signal and outputting a detect said ion result to the optical sending apparatus, and wherein

said optical sending apparatus generates said optical signal of said plurality of wavelength bands by generating sets of optical signals having different optical powers based on the detection result of the spectrum detecting section and

wavelength-multiplexing the sets of optical signals on a wavelength band basis.

35. The optical transmission system according to claim 29, wherein said plurality of optical adjusting means of the optical amplifying apparatus are optical amplifiers for amplifying optical signals.

36. The optical sending apparatus according to claim 29, wherein said plurality of optical adjusting means of the optical amplifying apparatus are optical attenuators for attenuating optical signals.

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37. A method of amplifying light comprising the steps of:

(1) amplifying light in a longer-wavelength band among a plurality of wavelength bands;

(2) amplifying light in a shorter-wavelength band among said plurality of wavelength bands so that it will have optical power that is larger than optical power of the amplified light in the longer-wavelength band; and

(3) wavelength-multiplexing light beams of the plurality of wavelength bands.

38. The optical amplifying method according to claim 37, further comprising a step of determining a difference between an amplification output of the light in said shorter-wavelength band and an amplification output of the light in said longer-wavelength band so that optical powers of the respective wavelength bands at a predetermined point will become approximately identical when wavelength-multiplexed light of the said plurality of wavelength bands travels to the predetermined point, and wherein

said step (2) amplifies said light in the shorter-wavelength band so that it will have optical power that is larger than optical power of amplified light in said longer-wavelength band by said difference.

39. A method of amplifying light comprising the steps of:

(1) generating a plurality of optical signals having different optical powers;

(2) generating a plurality of WDM optical signals by wavelength-multiplexing said plurality of optical signals on

a wavelength band basis;

(3) amplifying a WDM optical signal in a longer-wavelength band among the plurality of WDM optical signals;

(4) amplifying a WDM optical signal in a shorter-wavelength band among said plurality of WDM optical signals so that it will have optical power that is larger than optical power of the amplified WDM optical signal in said longer-wavelength band; and

(5) wavelength-multiplexing said plurality of WDM optical signals.

40. The optical amplifying method according to claim 39, further comprising a step of determining a difference between an amplification output of the WDM optical signal in said shorter-wavelength band and an amplification output of the WDM optical signal in said longer-wavelength band so that optical powers of the respective WDM optical signals at a predetermined point will become approximately identical when a wavelength-multiplexed optical signal of the plurality of WDM optical signals travels to the predetermined point, and wherein

said step (4) amplifies the WDM optical signal in said shorter-wavelength band so that it will have optical power that is larger than optical power of amplified light in the longer-wavelength band by said difference.

41. A method of inputting light comprising the steps of:

making optical power of a WDM optical signal in a shorter-wavelength band larger than optical power of a WDM optical signal in a longer-wavelength band among a plurality of WDM optical signals in respective wavelength bands; and

inputting said plurality of WDM optical signals in the respective wavelength bands to an optical transmission line.

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